A LOCAL SPECTRAL METHOD FOR STRUCTURAL ANALYSIS

G. W. Wei[a] , Y. B. Zhao[b] and **Y. Xiang[c]**
[a]Department of Mathematics, Michigan State University, East Lansing, Michigan 48824,
wei@math.msu.edu
[b]Department of Computational Science, National University of Singapore, Singapore 117543
[c]School of Engineering and Industrial Design, University of Western Sydney, Penrith South DC NSW 1797, Australia

Recently, discrete singular convolution (DSC) has emerged as a novel local spectral approach for structural analysis. In this paper, two significant studies, vibration analysis for rectangular plates with irregular internal supports and high frequency analysis for rectangular plates, are presented. The DSC vibration analysis, which is based on the strong formulation of the mechanics problem, exhibits excellent accuracy in several analytically solvable cases and therefore can be regarded as a promising method. In this method, implementation of the boundary conditions, such as the simply supported (S) edge and the clamped (C) edge, is formulated through delicate extension techniques, and internal supports are simulated through point supports. Some important results are presented. Successful applications certainly validate the robustness of the DSC for plate vibration analysis. Excellent agreement of the DSC results to the exact solutions, indicates its reliability and robustness in studying more complicated cases. Now, the available DSC results include

- DSC analysis for beam and simply supported plates [1-3].
- Frequency parameters for rectangular plates with a combination of simply supported, clamped and transversely supported (E) edges [8].
- Frequency parameters for rectangular plates with mixed boundary conditions [4].
- Frequency parameters for rectangular plates with internal supports, such as (partial) diagonal line supports, (partial) cross line supports, ring supports, square supports and rhombus supports [5,7].
- Frequency parameters for rectangular plates with irregular supports [9].
- Very high frequency parameters for rectangular plates [6,10].

References

[1] G.W. Wei, ``A new algorithm for solving some mechanics problems,'' *Computer methods for Applied Mechanics and Engineering*, v. 190, p. 2017-2030, 2001.

[2] G.W. Wei, ``Vibration analysis by discrete singular convolution,'' *Journal of Sound and Vibration*, v. 244, p. 535-553, 2001.

[3] G.W. Wei, ``Discrete singular convolution for beam analysis,'' *Engineering Structures*, v. 23, p. 1045-1053, 2001.

[4] G.W. Wei, Y.B. Zhao, and Y. Xiang, "Analysis of Rectangular Plates with Mixed Boundary Conditions by Discrete Singular Convolution," *International Journal of Mechanical Sciences*, v. 43, p. 1731-1746, 2001.

[5] G.W. Wei, Y.B. Zhao, and Y. Xiang, "Discrete singular convolution and its application to the analysis of plates with internal supports. I. Theory and algorithm," *International Journal for Numerical Methods in Engineering*, v. 55, p. 913-946, 2002.

[6] G.W. Wei, Y.B. Zhao, and Y. Xiang, "A novel approach for the analysis of high frequency vibrations," *Journal of Sound and Vibration*, v. 257, p. 207-246, 2002.

[7] Y. Xiang, Y.B. Zhao, and G.W. Wei, "Discrete singular convolution and its application to the analysis of plates with internal supports. II. Complex Supports," *International Journal for Numerical Methods in Engineering*, v. 55, p. 947-971, 2002.

[8] Y.B. Zhao and G.W. Wei, "DSC analysis of rectangular plates with nonuniform boundary conditions," *Journal of Sound and Vibration*, v. 255, p. 203-225, 2002.

[9] Y.B. Zhao, G.W. Wei, and Y. Xiang, "Plate vibration under irregular internal supports," *International Journal of Solids and Structures*, v. 39, p. 1361-1383, 2002.

[10] Y.B. Zhao G.W. Wei, and Y. Xiang , "Discrete singular convolution for the prediction of high frequency vibration of plate," *International Journal of Solids and Structures*, v. 39, p. 65-88, 2002.